CLAIMS

1. A system for product or document authentication, said system comprising:

a. one or more luminescent or fluorescent tags, said tags being applied to said product or document,

b. an optical scanning component for detecting a signal emitted by said tag, and

c. an information technology component for analyzing said signal.

2. The system of claim 1 wherein at least one of said tags has an emitted signal of known time resolution.

3. The system of claim 2 wherein said known time resolution is the time to decay to a predetermined value.

4. The system of claim 1 wherein at least one of said tags is a mixture of more than one compound.

5. The system of claim 2 wherein at least one of said tags is selected from the group consisting of dyes, inks and pigments.

6. The system of claim 4 wherein one of said tags is a mixture of a luminescent compound and a luminescence lifetime modifier.

7. The system of claim 6 wherein said luminescent compound is a lanthanide chelate.

8. The system of claim 2 wherein said known time resolution corresponds to an exponential, or sum of exponential, functions with decay constants (1/e) that fall in the time window of 1 microsecond to 1 second.

9. The system of claim 1 wherein said tag has characteristics that can be detected as an image, a wavelength, a decay time or a combination thereof.

10. The system of claim 1 wherein the substrate on which said tag is deposited is selected from the group consisting of paper, cloth, plastic, metal, leather, thread, metal or plastic foil, wrapping, coatings, films, holographic materials, label or card stock, printing inks, sprays, adhesives and glass.

11. The system of claim 1 wherein at least one of said tags is invisible to the human eye.

12. The system of claim 1 wherein one or more of said tags partially or completely overlaps another of said tags when applied to said product.

13. The system of claim 1 wherein said information technology component is capable of resolving the signal detected by said optical scanning system into components, each of which can be further analyzed.

14. The system of claim 13 wherein said further analysis comprises identification of the spectral characteristics of said component as a function of time.

15. The information technology component of claim 13 in which said further analysis also includes the determination of whether said tag is authentic.

16. The system of claim 1 in which said optical scanning component comprises a light source, tag, scanner, and information technology system.

17. The system of claim 1 in which said tags are applied at different times.

18. The system of claim 1 in which said tags are applied at the same time.

19. The system of claim 1 comprising two or more luminescent or fluorescent tags, at least one of said tags being a mixture of a lanthanide chelate and a luminescence lifetime modifier.

20. The system of claim 1 comprising two or more tags.

21. A system for product or document authentication, said system used to detect the presence of one or more luminescent or fluorescent dyes, wherein said dyes are applied to said product or document, and wherein said system comprises:

a. an optical scanning component for detecting signals emitted by said dyes, and

b. an information technology component for analyzing said signals.

22. The system of claim 21, wherein at least one of said tags is a mixture comprising a lanthanide chelate and a lifetime modifier selected from the group consisting of imidazoles, analogs of imidazole, derivatives of imidazole, phosphine oxide or pyridine oxides, polymers that provide coordination sites for metals, poly(vinyl acetate), poly(vinylpyrrolidinone), carboxylic acids, ketones, amides, alkene polymers, polyesters, and biopolymers.

23. The system of claim 21, wherein at least one of said tags has an emitted signal of known wavelength band and known decay time.

24. The system of claim 1 wherein the said tag is applied to a substrate using a method of printing, including ink jet, continuous ink jet, thermal transfer, pad, offset, gravure, flexographic, or screen printing.]

25. A method for authenticating a product or document, said method comprising:

a. labeling said product or document with one or more luminescent or fluorescent tags,

b. measuring the signals emitted from said tags using an optical scanning component, after said tags are illuminated with one or more appropriate energy sources, and

c. analyzing said signals using an information technology component.

26. The method of claim 25 in which at least one of said tags has an emitted signal of known time resolution.

27. The method of claim 25 in which the time for said tag to decay to a predetermined value is known.

28. The method of claim 25 in which at least one of said tags is invisible to the human eye.

29. A method for product or document authentication, said method being used to detect the presence of one or more luminescent or fluorescent dyes, wherein said dyes are applied to said product or document, and wherein said method comprises:

a. using an optical scanning component for detecting signals emitted by said dyes, and

b. using an information technology component for analyzing said signals.

30. A method for product or document authentication, said method being used to detect the presence of two or more dyes used as tags for said product or document, the combination of said dyes yielding a unique identifier, wherein said method comprises:

a. treating said tagged samples by exposing them to elevated temperature, electromagnetic radiation, or washing with selected solvents,

b. using an optical scanning component for detecting dye luminescence, and

c. comparing said dye luminescence detected vs. control samples treated by similar exposures to elevated

temperature, electromagnetic radiation, or washing with selected solvents.

31. A method of claim 30 in which at least one of the said tags is a lanthanide chelate, based on the lanthanide elements, including but not limited to, europium, terbium, samarium, gadolinium, neodymium, and ytterbium.

32. A method of claim 30 in which at least one of the said tags is a near-infrared dye

33. A method of claim 30 in which the luminescence of dye tags is recorded using a spectrophotometer

34. A method of claim 30 in which the decay time of luminescence of dye tags is used to establish a comparison of treated and untreated samples

35. A method of claim 30 in which luminescence peak intensities for dye tags are used to establish a comparison of treated and untreated samples.

36. A method of claim 30 in which the dye tagged samples are heated in a drying oven before spectral analysis at 50-250 C.

37. A method of claim 30 in which dye tagged samples are irradiated before spectral analysis using lamps that include, but are not limited to, xenon, halogen, or mercury, or laser sources that include but are not limited to, solid state, Nd/YAG, dye, or nitrogen lasers.

38. A method of claim 30 in which dye tagged samples are washed before spectral analysis with solvent.

39. The method of claim 38 wherein said solvent is selected from the group consisting of acetone, tetrahydrofuran, chlorocarbon, ethyl acetate, toluene, dimethyl sulfoxide, dimethylformamide, water and mixtures thereof.

40. A composition of metal chelates in which the metal center is coordinated to one or more ligands that display charge transfer absorption bands.

41. A composition of chelates of claim 40 in which the metal center is a lanthanide element, including but not limited to the elements, europium, terbium, samarium, neodymium, gadolinium or ytterbium.

42. A composition of chelates of claim 40 in which the ligand is composed of aromatic rings having electron donating substituents.

43. The composition of claim 42 wherein said electron donating substituents are selected from the group consisting of $-OH$, $-OR$, $-O^-$, $-NH_2$, $-NR_2$, $-NHR$, $-CO_2^-$, $-SO_3^-$ and $-SR$.

44. A composition of chelates of claim 40 wherein said ligand is composed of aromatic rings having electron withdrawing groups.

45. The composition of claim 44 wherein said electron withdrawing groups are selected from the group consisting of nitro, quinone, sulfonyl groups, ketone, aldehyde, carboxyl, carboxylic acid derivatives, groups and halogens.

46. A method for forensic analysis comprising the method of claim 25, wherein said product or document is additionally treated with heat or light.

47. The system of claim 1 wherein the characteristics that can be modified in each of said tags is selected from the group consisting of (a) dye, pigment or ink, (b) size or shape, (c) position of one tag in relation to another, and (d) ability to change with time or when exposed to conditions such as heat, light or contact with a solvent.

48. The system of claim 16 wherein said optical scanning component utilizes photoexcitation created by one or more pulsed light sources.